MANAGING EXPECTATIONS IN WEAPON SYSTEMS DEVELOPMENT

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"Oft expectation fails, and most oft there where most it promises."

—William Shakespeare
All's Well That Ends Well

Introduction

Carefully managing the expectations of soldiers and other key stakeholders can play a pivotal role in the development of weapon systems. Soldiers are an integral part of nearly all weapon systems, and they can have significant influence on expected, as well as actual, equipment performance. Increasingly, soldiers are involved earlier in the development process—long before the hardware and/or software is mature. Seeking soldier feedback earlier can save developers time and money by ensuring that a program is on the right track to achieve its performance objectives. Ensuring that expectations of key stakeholders are realistic can avoid creating perceptions that are either inflated or too low. This article provides examples of the potential impact of getting soldier feedback early in the materiel development process and examines how two different development teams managed the expectations of key stakeholders.

Effect Of Expectations

Soldier expectations can affect a weapon system's anticipated performance. There is a saying that goes, if a scientist is asked if a system works, he will say yes if it works once. If an engineer is asked, he will say yes if the system works most of the time. If an end user or soldier is asked, he will say no if the system fails once. This adage was clearly illustrated with the Ground Based Sensor Non-developmental Item Candidate Evaluation conducted at a Fort Bliss, TX, test range in spring 1991. Seven radars were evaluated for the opportunity to become the next air defense artillery forward-area sensor by competing in several tests to provide early warning and target-location data to supported Avenger weapon systems. The selected radar evaluated as "outstanding" actually could have been chosen more than a year earlier, but was competed against other radars at least in part because of its apparently "poor performance." What allowed the radar to go from poor to outstanding in 1 year? When asked, the contractor's engineers replied that they had only made relatively minor software modifications. From the outset, the radar still had ample capability to meet all shared operational requirements, but most important, the changes to the radar software reduced soldiers' confusion by lowering the number of false targets. The baseline version had caused soldiers to hear many audible tones and see many screen indications for aircraft that were not really there. One of the many factors contributing to the radar being selected as the winner was soldier confidence in the system and a willingness to trust the radar data when conducting simulated Avenger engagements. The winning radar is now fielded and known as the highly successful Sentinel.

Sentinel system and prime mover/power

Input To EFOGM

Soldiers also provided critical user input to the design of the Enhanced Fiber-Optic Guided Missile (EFOGM). A well-planned, short-duration evaluation was conducted early in the development process. Soldiers were carefully integrated into the program to ensure that they understood performance capabilities of the prototype system and their role in influencing the final product. The EFOGM early soldier evaluation was planned and conducted less than 3 months after a contract award. Key stakeholders, including the government EFOGM Project Office, soldiers from Fort Benning, GA, and the prime contractor, Raytheon, were cooperatively involved throughout the planning and conduct of the soldier evaluation. Preparation included an early safety assessment and interim safety release to cover the scope of expected soldier involvement; development of a data-collection plan and a questionnaire; and identification of environmental factors that might affect performance (noise, light, etc.). Both a pre-evaluation for

soldiers and a contractor system orientation were conducted. Lessons learned from the pre-evaluation were then applied to the evaluation conducted the following day. Each day's testing concluded with soldier outbriefs and questionnaires to capture real-time soldier feedback. The entire evaluation required less than 1 week and fewer than 20 soldiers, but it yielded significant design recommendations including the following:

• Create channel guides for missile retaining pins to ease reload operations, especially at night;
• Redesign gunner console screens to be thinner (more room was needed) and to be nonglare;
• Change filter locations to make them more accessible for required periodic maintenance;
• Add inside blackout curtains to reduce nighttime detection from screen glare; and
• Change gunner screen displays to be more intuitive and to guide gunners through correct steps.

THAAD flight test at White Sands Missile Range, NM

The changes (and more) were implemented to provide a superior product and to achieve significant cost savings.

THAAD System Enhancements

A critical element in the Theater High Altitude Area Defense (THAAD) system development included the management of expectations for its interim prototype called the User Operational Evaluation System (UOES). Unlike the short duration effort of the EFOGM development team, the THAAD team has included continuous soldier involvement over many years to support early development and to deploy, if necessary, with the UOES in a national emergency. The team found that if performance expectations became too high, then continued development of the THAAD objective system was at risk. In an era of tight research, development, test, and evaluation budgets, there was a concern that an overly optimistic perception of the prototype's performance could stop the effort to develop the objective system.

The THAAD UOES created an initial impression that it was a highly capable system based on well-packaged system segments, incorporating many military off-the-shelf components and government-furnished equipment. In fact, many individuals felt that the objective system capability was now there. If the warfighters relied too heavily on the system's perceived capabilities, they would push to prematurely deploy it at the expense of a more mature and dependable system. As such, numerous briefings were presented to explain the differences between developmental capabilities and documented soldier requirements.

Hundreds of thousands of lines of software code must still be completed to ensure THADD meets warfighter requirements. In addition, equipment design upgrades are still needed to make it sufficiently rugged for soldier use, and required comprehensive testing and evaluation must continue to validate its performance.

Conversely, a dilemma also existed if the expectations of the prototype's performance were too low. In particular, there was concern that the objective system's performance and suitability may have been prematurely judged. The THAAD team has made remarkable progress in developing and integrating a *complete weapon system* including launchers, radars, battle management systems, and missiles. There has been criticism of the missile for not hitting a target until its seventh and eighth intercept attempts. Yet there have been repeated successes of all ground segments and continued progress has been made in missile design durability and producibility. Many successfully fielded weapon systems required significantly more development during their prototype stages than THAAD. Again, the management of warfighters' and key decisionmakers' expectations was necessary to ensure that perceptions of performance and suitability were realistically aligned with the prototype nature of the UOES.

Today, THAAD is progressing into the engineering and manufacturing development phase while portions of the UOES (most notably the radar elements) are being evaluated for near-term surveillance missions. Early soldier input into the objective system design saved THAAD developers nearly $25 million.

Conclusion

Soldier involvement in the development process is a sure means to obtain valuable early feedback. A costly future test or design iteration/spiral can be avoided if soldier input is properly planned for and collected, and if soldier expectations are kept appropriate to the level of the design maturity of the system's hardware and software. The investment in continuous communication with warfighters and other stakeholders is essential to ensure that prototype capabilities are neither undersold nor overestimated. Today, military and industry program managers have increasingly more responsibilities and less time to carry them out. Therefore, careful attention to managing stakeholder expectations is paramount to reduce unnecessary risk and optimize resources. Expectation should succeed "where most it promises" to give soldiers the best possible product whenever it is needed.

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